I. Amendments to the Claims

This listing of claims replaces without prejudice all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) Apparatus for recognizing an input data stream, comprising:

a receiver for receiving the input data stream;

an interface for randomly selecting any one portion of the received data stream, and forming a first plurality of feature time series waveforms respectively corresponding to distinct portions of the received data stream;

a memory for storing a second plurality of feature time series waveforms; and

processor structure for correlating the first plurality of feature time series waveforms with the second plurality of feature time series waveforms, and for designating a recognition when a joint probability of multiple feature correlations ~~correlation values~~ between the first plurality of feature time series waveforms and at least one of the second plurality of feature time series waveforms indicates that random detection is not probable ~~reaches a predetermined value~~.

2. (Original) Apparatus according to Claim 1, wherein the data stream comprises audio data.

3. (Original) Apparatus according to Claim 1, wherein said data stream comprises video data.

4. (Original) Apparatus according to Claim 1, wherein said memory stores a second plurality of feature time series waveforms, which correspond to an entire broadcast work.

5. (Previously Presented) Apparatus according to Claim 1, further comprising a scheduler for (i) switching said receiver to a different input data stream after said processor designates the recognition and (ii) scheduling the sampling interval for each of said second plurality of feature time series waveforms.

6. (Previously Presented) Apparatus according to Claim 1, wherein said interface selects a plurality of portions of the received data stream to form the first plurality of feature time series waveforms.

7. (Previously Presented) Apparatus according to Claim 1, wherein said interface rank-orders the first plurality

of feature time series waveforms according to their information content to access a map of most likely candidate patterns.

8. (Previously Presented) Apparatus according to Claim 1, wherein said processor structure correlates the first plurality of feature time series waveforms with features from each time segment of each of the second plurality of feature time series waveforms stored in memory in an order corresponding to the descriptiveness of each of the second plurality of feature time series waveforms.

9. (Original) Apparatus according to Claim 1, wherein said receiver normalizes the input data stream to a fixed total power.

10. (Original) Apparatus according to Claim 1, wherein said interface performs a fast Fourier transformation on the received data stream to produce the first plurality of feature time series waveforms.

11. (Previously Presented) Apparatus according to Claim 1, wherein said interface integrates the received data stream over each of a plurality of spectral parameters and then performs a decimating filter function on the integration result

to produce the first plurality of feature time series waveforms.

12. (Original) Apparatus according to Claim 1, wherein said processor structure designates a recognition which includes a time position of the first plurality of feature time series waveforms within the received input data stream.

13. (Original) Apparatus according to Claim 1, wherein the input data stream comprises a broadcast work, and wherein the processor structure correlates (i) the first plurality of feature time series waveforms which represents any randomly-selected portion of the broadcast work, and (ii) the second plurality of feature time series waveforms which represents the entire broadcast work.

14. (Previously Presented) Apparatus according to Claim 1, wherein said processor correlates the first plurality of feature time series waveforms with the second plurality of feature time series waveforms by computing a plurality of partial pattern recognitions between the first plurality of feature time series waveforms and templates which correspond to the second plurality of feature time series waveforms, said processor estimating false alarm probabilities for each of the first plurality of feature time series waveforms, said

processor statistically combining said probabilities to estimate an overall probability that a possible detection is random.

15. (Previously Presented) Apparatus according to Claim 1, wherein said memory stores the second plurality of feature time series waveforms which are time-overlapped with respect to each other, and wherein said processor zero-fills each of the first plurality of feature time series waveforms to double their lengths prior to correlation.

16. (Currently Amended) Apparatus according to Claim 1, wherein said processor designates a ~~of~~ plurality of potential recognitions after a plurality of correlation probability values reaches the predetermined value, said processor then repeating the correlating and designating functions until only one of the second plurality of feature time series waveforms is designated as corresponding to the input data stream.

17. (Currently Amended) Apparatus for forming video features from an input stream, comprising:

a receiver for receiving an input video stream which corresponds to a video screen having a plurality of regions, the video screen comprising a plurality of pixels having intensity and color; and

processor structure for (i) receiving the video stream from the receiver, (ii) summing the pixel values of at least one of the intensity and the color of video signals corresponding to each of the plural areas of the video screen, (iii) forming a set of low rate time series waveforms from the pixels summed over each of the plural areas of the video screen, (iv) forming overlapping time intervals of the multiple feature time series waveforms such that the overlapping time intervals encompass the entire received video frame sequence, (v) determining the most distinctive information from each time interval, (vi) rank-ordering features of the time interval segments according to their information content, (vii) transforming the rank-ordered features of each of the time interval segments to produce complex spectra, and (viii) storing the resulting complex spectra as video features.

18. (Previously Presented) Apparatus according to Claim 17, wherein the processor forms the set of low rate time series waveforms by decimating the integrated video signal.

19. (Currently Amended) Apparatus for forming audio features from an input audio stream, comprising:

a receiver for receiving the input audio stream and separating the received audio stream into a plurality of different frequency bands; and

processor structure for (i) extracting energy from each of the plurality of frequency bands, (ii) summing the energy extracted from each of the plurality of frequency bands, (iii) forming multiple feature time series waveforms from the summed energy, (iv) forming overlapping time intervals of the multiple feature time series waveforms such that the overlapping time intervals encompass the entire received audio stream, (v) determining the information content of each feature from each time interval, (vi) rank-ordering each of the features of the time interval segments according to their information content, and (vii) transforming each of the rank-ordered features of the time interval segments to produce complex spectra; and

a memory for storing the transformed complex spectra.

20. (Currently Amended) A method for recognizing an input data stream, comprising the steps of:

receiving the input data stream;

randomly selecting any one time interval from the received data stream;

forming a first plurality of feature time series waveforms respectively corresponding to distinct portions of the received data stream;

rank ordering features of the first plurality of waveforms according to their information content;

retrieving a second plurality of feature time series waveforms;

correlating the first plurality of feature time series waveforms with the second plurality of feature time series waveforms in an order corresponding to (i) a map of candidate patterns from the second plurality of feature time series waveforms that best match the rank ordering of the first plurality of feature time series waveforms and (ii) the rank ordering of second plurality of feature time series waveforms; and

designating a recognition when a joint correlation probability value of multiple feature correlations between the first plurality of feature time series waveforms and at least one of the second plurality of feature time series waveforms indicates that random detection is not probable ~~reaches a predetermined value~~.

21. (Currently Amended) A method for forming video features from an input video stream, comprising the steps of:

receiving an input video stream which corresponds to a video screen having a plurality of regions, the video screen comprising a plurality of pixels having luminance and chrominance;

summing the pixel values of at least one of the intensity and the color of video signals corresponding to each of the plural areas of the video screen;

forming a set of low rate time series feature waveforms from the pixels summed over each of the plural areas of the video screen;

forming overlapping time intervals of the multiple feature waveforms such that the overlapping time intervals encompass the entire received video frame sequence;

determining the most distinctive information from each time interval;

rank-ordering the features of the time interval segments according to their information content;

transforming each feature of the rank-ordered time interval segments to produce complex spectra; and

storing the transformed complex spectra as video features.

22. (Currently Amended) A method for forming audio features from an audio stream, comprising the steps of:

receiving the input audio stream and separating the received audio stream into a plurality of different frequency bands;

extracting energy from the plurality of frequency bands;

summing the energy extracted from each of the plurality of frequency bands;

forming multiple feature waveforms from the summed energy;

forming overlapping time intervals of the multiple feature waveforms such that the overlapping time intervals encompass the entire received audio stream;

determining the most distinctive information from each time interval;

rank-ordering features of the time interval segments according to their distinctiveness;

transforming the rank-ordered time interval segments to produce complex spectra; and

storing the transformed complex spectra as audio features.

23. (Currently Amended) A computer readable storage medium for storing a program which causes one or more

computers to recognize an input data stream, the stored program causing the one or more computers to:

receive the input data stream;

randomly select any time interval of the received data stream;

form a first plurality of feature time series waveforms from the received data stream which respectively correspond to spectrally distinct portions of the received data stream;

store a second plurality of feature time series waveforms;

correlate the first plurality of feature time series waveforms with the second plurality of feature time series waveforms in an order corresponding to (i) a map of candidate patterns from the second plurality of feature time series waveforms that best match the rank ordering of the first plurality of feature time series waveforms and (ii) the rank ordering of second plurality of feature time series waveforms; and

designate a recognition when a joint correlation probability value of multiple feature correlations between the first plurality of feature time series waveforms and at least one of the second plurality of feature time series waveforms indicates that random detection is not probable ~~reaches a predetermined value~~.

24. (Currently Amended) A computer readable storage medium which stores a program which causes one or more computers to form video features from an input video stream, the program causing the at least one computer to:

receive an input video stream which corresponds to a video screen having a plurality of regions, the video screen comprising a plurality of pixels having intensity and color;

sum the pixel values of at least one of the intensity and the color of video signals corresponding to each of the plural areas of the video screen;

form a set of low rate time series feature waveforms from the pixels summed over each of the plural areas of the video screen;

form overlapping time intervals of the multiple feature waveforms such that the overlapping time intervals encompass the entire received video frame sequence;

determine the most distinctive information from each time interval;

rank-order the features of the time interval segments according to their information content;

transform the rank-ordered features of each of the time interval segments to produce complex spectra; and

store the transformed complex spectra as video features.

25. (Currently Amended) A computer readable storage medium which stores a program that causes one or more computers to form audio features from an audio stream, the program causing the one or more computers to:

receive an input audio stream and separating the received audio stream into a plurality of different frequency bands;

extract energy from the plurality of frequency bands;

sum the energy extracted from each of the plurality of frequency bands;

form multiple feature time series waveforms from the summed energy;

form overlapping time intervals of the multiple feature streams such that the overlapping time intervals encompass the entire received audio stream;

determine the most distinctive information from each time interval;

rank-order the features of the time interval segments according to their information content;

transform the rank-ordered time interval segments to produce complex spectra; and

store the transformed complex spectra as audio features.

26. (Currently Amended) A method for forming recognition features from an input data stream, comprising the steps of:

receiving the input data stream;

forming a plurality of feature time series waveforms which respectively correspond to distinct portions of the received input data stream;

forming multiple feature streams from the plurality of feature time series waveforms;

forming overlapping time intervals of the multiple feature streams;

estimating the distinctiveness of each feature in each time interval;

rank-ordering the features according to their information content;

transforming the feature time series waveforms to obtain complex spectra; and

storing the feature complex spectra as the recognition features.

27. (Currently Amended) A method of using recognition features from an input data stream to achieve automatic signal identification, comprising the steps of:

receiving the input data stream;

forming a plurality of time series waveforms which correspond to all features of the received input data stream;

forming multiple feature streams from the plurality of feature time series waveforms;

correlating the most distinctive feature of plural stored candidate patterns with the multiple feature streams formed from the unknown input data stream in an order corresponding to a map of candidate patterns that best match the rank ordering of the plurality of feature time series waveforms; and

designating recognition of the input data stream when a joint probability of multiple feature correlations between the input data stream and the stored candidate patterns indicates that random detection is not probable.

~~estimating the probability that the resulting correlation value could occur from a random event;~~

~~rejecting a candidate pattern if the probability of random detection is above a specified rejection threshold;~~

~~accepting a candidate pattern if the probability of random detection is below a specified acceptance threshold;~~

~~for unresolved candidate patterns, performing~~

~~additional correlations with additional features in an order specified by the distinctiveness of each feature;~~

~~for unresolved candidate patterns, estimating the joint probability of random pattern detection;~~

~~rejecting a candidate pattern if the joint probability of random detection is above a specified rejection threshold;~~

~~accepting a candidate pattern if the joint probability of random detection is below a specified acceptance threshold;~~

~~repeating the steps of correlating additional features, updating the joint probability of random detection, and evaluating joint probabilities until a decision can be made for every candidate pattern.~~

28. (Previously Presented) An apparatus according to Claim 19, wherein the multiple feature streams are grouped into frames of multiple frequency band energy sampled in time.

29. (Previously Presented) An apparatus according to Claim 19, wherein said most distinctive information corresponds to the most reliable features.

30. (Previously Presented) A method according to claim 20, wherein the map of candidate patterns from the second plurality comprises a set of lists indicating which candidate patterns are most likely to match the first plurality of feature time series waveforms.

31. (Previously Presented) A method according to claim 20, wherein recognition is designated when the joint correlation probability indicates that the error rate is less than a designated threshold.

32. (Previously Presented) A method according to claim 21, wherein the video stream represents a monochromatic image.

33. (Previously Presented) The method of claim 21, wherein the video averaging step comprises summing pixel values from distinct regions of a video frame sequence.

34. (Previously Presented) The method of claim 21, wherein the low rate video time series streams are formed by time averaging and decimating each of the plural video feature streams.

35. (Previously Presented) A method according to claim 22, wherein the separation into a plurality of different frequency bands is accomplished through a set of bandpass filters.

36. (Previously Presented) A method according to claim 22, wherein the separation into a plurality of different frequency bands is accomplished through spectral analysis using at least one of a DFT, FFT, and DCT transform.

37. (Previously Presented) A method according to claim 22, wherein the multiple feature streams are formed by sampling the energy in each of the plurality of frequency bands.

38. (Previously Presented) A method according to claim 22, wherein the multiple feature streams form overlapping time intervals that (i) are redundant and (ii) provide no gaps between time interval segments.

39. (Previously Presented) A method according to claim 22, wherein the multiple feature streams within each time interval are rank ordered according to their reliability.

40. (Previously Presented) Computer readable storage medium according to claim 23, wherein time series waveforms from the first plurality of feature time series waveforms are matched with corresponding time series waveforms from the second plurality of feature time series waveforms in an order determined from the relative reliability of the individual features.

41. (Cancelled)

42. (Previously Presented) Computer readable storage medium according to claim 24, wherein the multiple feature time series waveforms are formed by filtering and sampling the plural integrated regions from a sequence of video frames.

43. (Previously Presented) Computer readable storage medium according to claim 24, wherein the multiple feature time series waveforms form overlapping time intervals that (i) are redundant and (ii) provide no gaps between time interval segments.

44. (Previously Presented) Computer readable storage medium according to claim 26, wherein the multiple feature waveforms are formed from an audio signal.

45. (Previously Presented) Computer readable storage medium according to claim 26, wherein the multiple feature time series waveforms are formed from a video signal.

46. (Previously Presented) A method according to claim 26, where the input data stream comprises audio.

47. (Previously Presented) A method according to claim 26, where the input data stream comprises video.

48. (Previously Presented) A method according to claim 26, where the input data stream comprises both audio and video.

49. (Previously Presented) A method according to claim 27, where the candidate patterns stored in the database are correlated with similar features of the multiple feature time series waveforms formed from the unknown input according to a reliability of each feature in identifying the unknown input.

50. (Previously Presented) A method according to claim 27, where the multiple feature time series waveforms of the unknown input are ranked ordered according to their distinctiveness and reliability.

51. (Previously Presented) A method according to claim 27, where the rank ordered multiple feature time series waveforms of the unknown input are used to access a lookup table of links to the most likely patterns stored in the database.